Ref. No.	1900·0. x.	1900·0. y.	1900·0. R.A.	1900·0. Decl.
	′	′	h m s	° ′ ″
46	+ 2·550	−2·607	16 38 12·71	+36 37 23·5
47	+ 2·654	−0·090	38 13·24	39 54·5
48	+ 3·186	−4·306	38 15·87	35 41·6
49	+ 3·196	−4·881	38 15·92	35 7·1
50	+ 3·228	+1·140	38 16·10	41 8·3
51	+ 3·352	+4·739	38 16·73	44 44·3
52	+ 3·360	+0·332	38 16·76	40 19·9
53	+ 3·572	−2·096	38 17·80	37 54·2
54	+ 3·576	−5·911	38 17·81	34 5·3
55	+ 4·092	−1·206	38 20·40	38 47·5
56	+ 4·228	+0·438	38 21·08	40 26·2
57	+ 4·315	+4·864	38 21·54	44 51·7
58	+ 4·504	+1·461	38 22·47	41 27·5
59	+ 4·620	−3·228	38 23·02	36 46·2
60	+ 4·636	+5·332	38 23·14	45 19·8
61	+ 5·045	−0·819	38 25·15	39 10·7
62	+ 5·308	−5·020	38 26·44	34 58·7
63	+ 5·624	+3·228	38 28·06	43 13·5
64	+ 6·722	+1·002	38 33·53	40 59·8
65	+ 7·110	−6·172	38 35·41	33 49·4
66	+ 8·166	−1·300	38 40·71	38 41·6
67	+ 8·222	−0·669	38 41·00	39 19·4
68	+ 8·468	−3·642	38 42·20	36 21·0
69	+ 8·900	+0·666	38 44·39	40 39·4
70	+10·003	−0·938	16 38 49·88	36 39 3·1

University Observatory, Oxford:
1904 *November* 8.

Note on the Variation of ε Aurigæ. By Colonel E. E. Markwick.

Dr. Ludendorff, of Potsdam, has recently published a paper on the variability of ε *Aurigæ*, in which he reaches some rather remarkable conclusions. Having discussed a considerable number of observations of the brightness of this star made by observers of repute, commencing with those of Argelander in 1842, he

finds that the light-variation is of the Algol-type. The extraordinary part of the result is the great length of the period—$54\frac{1}{4}$ years. Minima occur, or follow one another, after 9905^d, or $27{\cdot}12$ years. As they are possibly unequal in brightness, it is concluded they represent the passing of the lesser star between us and the primary, followed by a passing of the same behind or the other side of the primary. The duration of the light change is $1{\cdot}99$ years, divided symmetrically as follows:—

	d.
From cessation of normal light to commencement of minimum	207
Duration of minimum	313
From end of minimum to resumption of normal light	207
	727

Total period of light change = $1{\cdot}99$ years.

The middle epoch of last minimum occurred in 1902 March 31.

The variation, as given by Ludendorff, amounts to $0^m{\cdot}73$, or from $3^m{\cdot}35$ to $4^m{\cdot}08$ (see *Astron. Nach.* 3918–19–20).

Taking the *Provisional Catalogue of Variable Stars*, published by Harvard College Observatory, we find that the periods of the Algol-type stars range from $31^d{\cdot}3$, the longest, to $0^d{\cdot}5$, the shortest. Even the former is exceptionally long—far more so than the average. The $54\frac{1}{4}$-year period is therefore most remarkable by comparison.

As ϵ *Aurigæ* has been on my working list for a number of years, I thought it would be of interest to inquire whether my work bears out the results just alluded to. My observations number in all 126, extending from 1888 March 18 to 1904 May 2. In addition I have received from Mr. W. E. Besley four observations made in the years 1895 and 1896. These 130 determinations of brightness were made visually by Argelander's method, and are reduced to the scale of the *Revised Harvard Photometry*. They are given at the end of this note.

In the first two observations the comparison star used was θ *Aurigæ*. From 1888 November 30 to 1897 January 30 η was generally the comparison star, with occasionally θ in addition. From 1897 March 1 to 1899 η, ζ, and ι. From 1899 October 23 onwards η and ι only, except in 1902.

The observations from the commencement to 1892 March 8 were made in Ireland; from 1895 January 29 to 1898 May 10 in Gibraltar; thereafter in England. Those marked * are referred to by Ludendorff in his paper.

Certain notes from the original observing books are entered in the column headed Remarks. It was not thought necessary to encumber the list with the detailed light-comparisons.

The magnitudes of the comparison stars adopted are as follows, being taken from the R.H.P.

		m.
η *Aurigæ*	... ...	3·26
θ ,,	... ...	2·70
ζ ,,	... ...	3·80
ι ,,	... ...	2·99

I may say that the whole of the observations were made practically with the naked eye.

Before proceeding further I should like to remark that little or no importance is attached to the second decimal in the deduced magnitudes of ε *Aurigæ*. The comparisons were generally made in tenths of a magnitude; the two decimals come out when deducing the brightness from the magnitudes of the comparison stars which are given to two places of decimals in the R.H.P.

The observations, as contained in the list, have been plotted on square-ruled paper, the ordinate representing one magnitude in brightness corresponding in length to the abscissa for one-third of a year. Three methods have been adopted: 1. The magnitudes were all plotted direct from the list, and the points joined. The result is a series of zigzag lines for each season, all of which, with the exception of three observations in the year 1902, run fairly near the line representing $3^{m}·0$. The three observations of 1902, however, are much below this, their mean being practically $4^{m}·0$. For all the period under discussion, excluding 1902, the magnitudes are absolutely comprised within the limits 2·47 and 3·53. It is noticed incidentally that observations in April or May are usually higher (brighter) than any others. These curves are not reproduced here.

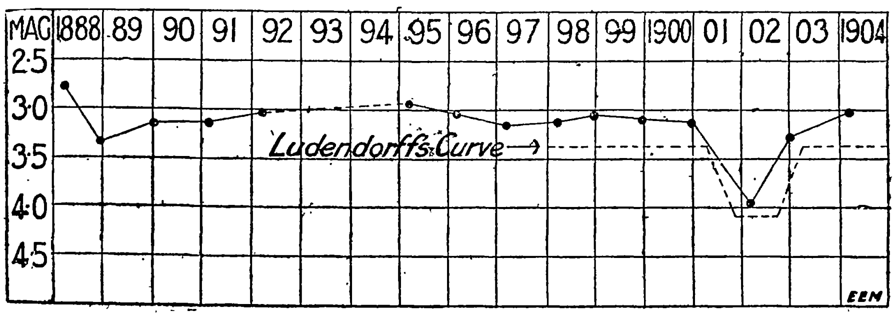

Fig. 1.

2. In order to smooth the asperities in the curves or lines just referred to, the mean brightness for each "season" has been taken, and the results plotted. This is represented in fig. 1. A glance at this diagram shows the brightness of the star to have been fairly constant, except in the season 1901–02, when there was a marked diminution of light corresponding to about 1 m.

Expressed in figures, the mean brightness for seasons is as follows :—

Season.	Magnitude.	No. of Observations.	Season.	Magnitude.	No. of Observations.
1888	2·80	2	1897	3·17	11
1888–1889	3·35	11	1898	3·11	15
1889–1890	3·18	8	1898–1899	3·08	19
1891	3·12	7	1899–1900	3·10	15
1892	3·05	8	1900–1901	3·13	12
Interval			1902	3·97	3
1895	2·96	1	1902–1903	3·26	5
1896	3·06	4	1904	3·04	9

Superposed in fig. 1 is the light curve as deduced by Ludendorff, and it is at once seen that my observations support his result exactly, so far as the year 1902 is concerned. I regret that for some reason or another I did not make more observations in 1902 and 1903, whence the shape of the light curve might have been more accurately determined for the period of the light fluctuation. I have no observations bearing on the previous minimum in 1874–1875.

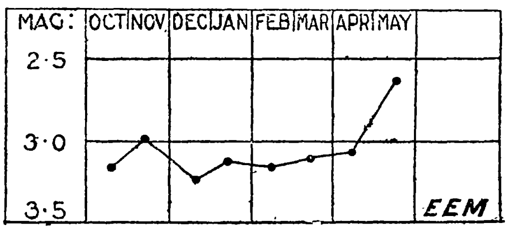

Fig. 2.

I may add that the mean of four observations made thi season (1904) is $3^{m}\cdot13$, or about "normal" light.

3. Reference is made above to the apparent increased brightness of ε *Aurigæ* in May. I have therefore taken out the mean brightness by months, with the exception of the year 1902. The following is the result :—

Month.	Mean brightness.	No. of Observations.	Month.	Mean brightness.	No. of Observations.
October	3·18	4	February	3·19	21
November	3·00	4	March	3·11	40
December	3·26	15	April	3·09	16
January	3·14	24	May	2·64	3

These magnitudes are plotted in fig. 2. It is seen that from the beginning of the year until the end of the season there is an apparent tendency for the brightness to increase.

This increase is, I believe, subjective, and due to the difficult conditions under which the star is observed in April and May.

ε Aurigæ is a circumpolar star for the latitude of London, and as the year advances it can only be seen low down on the northern horizon with a background of bright twilight. One would imagine that with a brighter background there would be a tendency to make or estimate the star fainter than usual on this very account. Our curve, however, indicates the reverse of this; and as the observations are differential, or made by comparison with other stars, I am rather inclined to attribute the apparent increase in brightness to "position angle"—that is, to the different angle made with the vertical by the line joining the variable and the comparison star compared with the same angle when the constellation is higher in the sky. For example, I have noted more than once when observing in May that *ι Aurigæ* is getting vertically below ε, and immersed in the mists of the horizon.

There is a moral in all this for variable-star observers. Do not tire in watching a variable such as the one now in question, or *α Cassiopeiæ*, *α Orionis*, &c. One may observe for years without any change, and when one least expects it an important and marked change may occur. Although, according to Ludendorff's result, no further change is due for twenty-five years, yet I would urge observers to keep a watch on *ε Aurigæ* with a view to confirming the remarkable result already announced.

Observations of (Ch. 1768) ε Aurigæ.

Date.	Mag.	Remarks.
1888.		
Mar. 18	2·8	
30	2·8	
Nov. 30	3·0	
Dec. 8	3·53	
24	3·53	
29	3·4	
1889.		
Jan. 29	3·4	
Feb. 20	3·46	
27	3·26	
Mar. 4	3·4	
5	3·4	
Apr. 17	3·4	
21	3·06	
Dec. 18	3·4	
20	3·1	
24	3·1	

Date.	Mag.	Remarks.
1890.		
Jan. 23	3·16	*
Feb. 13	3·1	*
20	3·16	*
Mar. 19	3·16	*
29	3·3	*
1891.		
Jan. 9	3·4	*
Mar. 2	3·06	*
5	3·16	*
8	2·93	*
10	3·08	*
20	3·1	* Moonlight
Apr. 2	3·08	*
1892.		
Jan. 1	3·0	*
3	3·1	*
5	3·0	* Moonlight

Date.		Mag.	Remarks.
1892.			
Jan.	24	3·06	*
	27	3·01	*
	29	3·1	*
Feb.	24	3·1	*
Mar.	8	3·0	* Moonlight
Interval			
1895.			
Jan.	29	2·96	
1896.			
Jan.	15	3·16	
Feb.	20	3·06	
Mar.	3	29·6	Sky hazy
	17	3·06	
1897.			
Jan.	1	3·01	
	30	3·26	
Mar.	1	3·17	
	5	3·17	
	9	3·17	Moonlight
	20	3·07	
	21	3·17	
	24	3·22	
	25	3·22	
Apr.	5	3·33	Moonlight
	8	3·07	
1898.			
Jan.	16	3·27	
	21	3·17	Position awkward, near zenith
	23	3·22	
	25	3·27	
Feb.	15	3·40	
	24	3·17	Moonlight
	25	3·22	
Mar.	13	3·22	
	23	3·08	
	25	2·98	Moonlight
Apr.	15	2·98	ε and η at nearly same altitude
	21	2·92	
	22	2·95	
	23	2·95	Moonlight

Date.		Mag.	Remarks.
1898.			
May	10	2·78	
Dec.	19	3·30	Moonlight
	20	3·32	Moonlight
	22	3·12	
	29	2·95	
1899.			
Jan.	14	2·72	
	26	3·12	Moonlight
Feb.	2	3·15	
	22	2·92	
	27	3·12	Sky poor
	28	3·07	
Mar.	1	3·10	
	2	2·88	Sky poor
	4	3·08	
	5	3·22	
	9	3·22	
	13	2·98	
	14	3·12	
	15	3·05	Moonlight
Apr.	3	3·12	
Oct.	23	3·22	Moonlight
	28	3·18	
	31	3·15	
Nov.	10	2·82	Moonlight
1900.			
Jan.	25	3·27	
Feb.	7	3·17	Moonlight
Mar.	4	3·27	
	17	3·07	Moonlight
	30	2·97	Very poor sky
	31	3·30	
Apr.	17	3·22	
	21	3·27	Very bad sky
	26	2·92	Twilight
	28	3·02	
May	7	2·67	Moonlight
Oct.	21	3·17	
Nov.	18	3·12	

Date.	Mag.	Remarks.
1900. Nov. 27	3·06	Observations by W. E. Besley
Dec. 13	3·18	
15	3·18	
19	3·18	
21	3·17	
1901. Feb. 5	3·02	Moonlight
14	3·02	
15	3·07	
Mar. 15	3·07	
22	3·27	ι seemed very bright
1902. Apr. 16	4·0 ±	"Reliable, I think; but it is a colder whiter tint than ζ"
May 4	3·70	Bright twilight
10	4·20	Compared only with ζ, as ι was too near the horizon
1902. Dec. 24	3·39	
1903. Jan. 23	3·17	
28	3·20	
Feb. 23	3·31	
Mar. 3	3·25	"Most difficult to judge"
1904. Jan. 16	3·22	
19	3·22	
Feb. 6	3·12	Mean of two observations
13	3·17	
15	3·02	
Mar. 10	3·02	
Apr. 9	2·92	
12	3·22	ι looked reddish
May 2	2·47	Bright twilight

Telescopic Observation of a Meteor Trail. By W. Shackleton, A.R.C.Sc. (Lond.)

Whilst making a search for Encke's Comet towards midnight of October 12 I was startled by the field of view becoming suddenly illuminated, and on moving the telescope a few minutes in right ascension a bright ribbon-like streak came at once into view, which I was astonished to find sinuous and double. Glancing momentarily to the sky a long trail, evidently left by a meteor, was visible; moreover the trail appeared perfectly straight as far as the naked eye could judge. There was no doubt, however, that the trail, when observed under a magnifying power of 46, was irregular, the deviations bearing a strong resemblance to the path of an electric spark through air, except that the contortions were smaller and less rigid than is usually shown when the electric current takes the path of least resistance. The field of view of the telescope was 40′·5, and on tracing the trail by moving the telescope some three or four kinks were visible in each succeeding field.

The path of the meteor lay nearly in a circle of right ascension, and a movement of the telescope in declination showed that the whole trail was marked by these undulations, with here